

MEMORANDUM

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Subject: Further Study and Inquiry into the Origin of SARS-CoV-2

From: Sara M. Tharakan, Coordinator, Analyst in Global Health and International Development, stharakan@crs.loc.gov, 7-9040
Hassan Z. Sheikh, Coordinator, Analyst in Public Health Emergency Management, hsheikh@crs.loc.gov, 7-0435
Susan V. Lawrence, Specialist in Asian Affairs, slawrence@crs.loc.gov, 7-2577
Sarah A. Lister, Specialist in Public Health and Epidemiology, slister@crs.loc.gov, 7-7320
Katarina C. O'Regan, Analyst in Foreign Policy, koregan@crs.loc.gov, 7-3521
Tiaji Salaam-Blyther, Specialist in Global Health, tsalaam@crs.loc.gov, 7-7677
Pervaze A. Sheikh, Specialist in Natural Resources Policy, psheikh@crs.loc.gov, 7-6070

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Introduction and Methodology

The origin of SARS-CoV-2, the virus that causes Coronavirus Disease 2019 (COVID-19), is unknown. Efforts to determine the origin of SARS-CoV-2 are ongoing. The World Health Organization (WHO) released a report (WHO Origin Report) in March 2021 that reviewed four possible hypotheses for the origin of SARS-CoV-2, but made no determination of the origin of the virus.¹ These hypotheses include:

- (1) Introduction through an intermediate host—an intermediate host species, infected by an animal reservoir host (the animal where the virus lives, grows, and multiplies), carried the virus and transmitted it to humans.
- (2) Direct zoonotic spillover—SARS-CoV-2 was transmitted from an animal reservoir host to humans.
- (3) Introduction through cold/food-chain products—people contracted SARS-CoV-2 through contact with contaminated food, potentially including frozen, imported foodstuffs.
- (4) Introduction through a laboratory incident—laboratory staff contracted and later spread SARS-CoV-2 while researching coronaviruses in bats.²

¹ World Health Organization (WHO), “Origins of the SARS-COV-2 virus,” WHO, March 30, 2021, <https://www.who.int/health-topics/coronavirus/origins-of-the-virus>.

² For a summary of the WHO report on the origins of SARS-CoV-2, the virus that causes COVID-19, and related key developments, please see CRS In Focus IF11822, *Origins of the COVID-19 Pandemic*, coordinated by Tiaji Salaam-Blyther.

On August 27, 2021, the U.S. Intelligence Community (IC) reported that it was unable to provide a definitive explanation of the origin of SARS-CoV-2.³ Other entities have also attempted to determine the origin of SARS-CoV-2 and have recommended further studies and data collection to assist in finding the origin of SARS-CoV-2.

Drawing on a wide range of literature, this memorandum provides potential options presented by scientists for further study into the origin of SARS-CoV-2 as well as a discussion on China's position on international calls for further investigative work. CRS reviewed the following references when preparing this memorandum:

- peer-reviewed scientific literature;
- the WHO Origin Report;
- select review articles in scientific journals; and
- unclassified government reports, where available.

The selection of potential approaches for further study into the origin of SARS-CoV-2 discussed in this memorandum are summarized from the literature. When considering these options and ideas the following caveats apply:

- These potential options are reflective of the scientific literature they are drawn from and not derived from CRS analysis;
- Research regarding the origins of SARS-CoV-2 is subject to change and this memorandum discusses literature available before September 17, 2021;
- The information in this memorandum is being provided in a time-limited situation and is not intended to be comprehensive.

These potential options for further study were identified by the WHO team and scientific experts knowledgeable in the investigations into the virus's origin. We selected for presentation here those articles that synthesized evidence and recommendations relevant to a given origin theory advanced by the WHO team, or additional hypotheses when such articles were available. CRS presented a few of the most complete and authoritative reviews and recommendations for each of the four categories below.

Selected literature discussing further avenues of scientific study are cited in the **Appendix** under four categories that reflect hypotheses discussed in the WHO Origin Report. The categories are:

- Studies related to the possibility of a laboratory or research related origin;
- Studies and data on SARS-CoV-2 features;
- Studies and data to address a potential zoonotic origin of SARS-CoV-2; and
- Human epidemiology studies.

The **Appendix** includes citations for each of these four categories.

³ Office of the Director of National Intelligence, *Unclassified-Summary-of-Assessment-on-COVID-19-Origins*, August 26, 2021, <https://www.dni.gov/files/ODNI/documents/assessments/Unclassified-Summary-of-Assessment-on-COVID-19-Origins.pdf>.

Studies Related to the Possibility of a Laboratory or Research Related Origin

Some policymakers and scientists have debated whether SARS-CoV-2 originated from the Wuhan Institute of Virology (WIV) or other laboratories located in Wuhan, China.⁴ The WHO Origin Report examined a hypothesis that SARS-CoV-2 was spread through an accidental infection of staff. The WHO Origin Report did not examine the hypothesis that SARS-CoV-2 spread via “deliberate release or deliberate bioengineering.”⁵ On March 30, 2021, after the initial release of the WHO Origin Report, the WHO Director-General Dr. Tedros Adhanom Ghebreyesus stated that

The team also visited several laboratories in Wuhan and considered the possibility that the virus entered the human population as a result of a laboratory incident. However, I do not believe that this assessment was extensive enough. Further data and studies will be needed to reach more robust conclusions. Although the team has concluded that a laboratory leak is the least likely hypothesis, this requires further investigation....⁶

On May 26, 2021, President Biden announced that he had asked the IC to prepare a report that examined whether the virus originated from human contact with an infected animal or from a laboratory accident.⁷ During the time the IC was working on this investigation, on July 15, 2021, Director-General Dr. Tedros called for “...China to be transparent, open and cooperate, especially on the information, raw data that we asked for at the early days of the pandemic,” and stated that there had been a “premature push” to rule out the possibility that SARS-CoV-2 had escaped from the WIV.⁸ The IC report, an unclassified summary of which was released on August 26, 2021, stated that

Most [U.S. government] agencies also assess with low confidence that SARS-CoV-2 probably was not genetically engineered; however, two agencies believe there was not sufficient evidence to make an assessment either way.⁹

One organization in the IC assessed

...with moderate confidence that the first human infection with SARS-CoV-2 most likely was the result of a laboratory-associated incident, probably involving experimentation, animal handling, or sampling by the Wuhan Institute of Virology.¹⁰

Overall, the IC determined that it is

...unable to provide a more definitive explanation for the origin of COVID-19 unless new information allows them to determine the specific pathway for initial natural contact with an animal

⁴ See e.g. Amy Maxmen, Smriti Mallapaty, “The COVID lab-leak hypothesis: what scientists do and don’t know,” *Nature*, June 08, 2021, <https://www.nature.com/articles/d41586-021-01529-3>; and Carl Zimmer, James Gorman, Benjamin Muller, “Scientists Don’t Want to Ignore the ‘Lab Leak’ Theory, Despite No New Evidence,” *The New York Times*, May 27, 2021, <https://www.nytimes.com/2021/05/27/health/wuhan-coronavirus-lab-leak.html>.

⁵ WHO Origin Report, p. 118.

⁶ WHO, “WHO Director-General’s remarks at the Member State Briefing on the report of the international team studying the origins of SARS-CoV-2,” March 30, 2021, at <https://www.who.int/director-general/speeches/detail/who-director-general-s-remarks-at-the-member-state-briefing-on-the-report-of-the-international-team-studying-the-origins-of-sars-cov-2>.

⁷ The White House, “Statement by President Joe Biden on the Investigation into the Origins of COVID-19,” press release, May 26, 2021.

⁸ Frank Jordan, Maria Cheng, “WHO chief says it was ‘premature’ to rule out COVID lab leak,” *Associated Press News*, July 15, 2021, <https://apnews.com/article/joe-biden-world-news-health-science-coronavirus-pandemic-c0c594f9060f676c0ea48c2d1c69daec>.

⁹ Office of the Director of National Intelligence, *Unclassified-Summary-of-Assessment-on-COVID-19-Origins*, August 26, 2021, <https://www.dni.gov/files/ODNI/documents/assessments/Unclassified-Summary-of-Assessment-on-COVID-19-Origins.pdf>.

¹⁰ See Computer Security Resource Center (CSRC), “Intelligence Community,” *Ibid*.

or to determine that a laboratory in Wuhan was handling SARS-CoV-2 or a close progenitor virus before COVID-19 emerged.¹¹

Discussions on the origin of SARS-CoV-2 may raise broader issues regarding international policies governing *biosafety* and *biosecurity*, which are overseen by WHO and the World Organization for Animal Health (OIE), among other international organizations, all of whom oversee the implementation of the Global Health Security Agenda (GHSA) and the International Health Regulations 2005 (known as IHR (2005) for the year it was published). The GHSA was founded in 2014 as a multilateral effort to encourage implementation of the IHR (2005), particularly in resource-poor countries.¹² IHR (2005) provided expanded means for controlling infectious disease outbreaks beyond quarantine. The regulations include a code of conduct for notification of and responses to disease outbreaks with pandemic potential, and carry the expectation that countries (and their territories) will build the capacity, where lacking, to comply with the IHR (2005), including adequate biosafety and biosecurity policies.¹³ IHR (2005) does not have an enforcement mechanism, despite efforts by some to include one in the wake of China's delayed reporting of the 2002-2003 Severe Acute Respiratory Diseases (SARS) outbreak.

Biosafety policies are defined as those that protect laboratory workers, the surrounding environment and the community from exposure or accidental release of infectious or hazardous materials from laboratories.¹⁴ *Biosecurity* policies are those that generally keep certain biological agents, toxins, and material within laboratories from unauthorized misuse, diversion or release.¹⁵ While specific biosafety policies at individual laboratories may vary depending on the type of agent being studied and the relevant government's laws and policies, generally, standard response protocols to events that result (or potentially result) in the release or exposure of a biological agent (to laboratory personnel or the surrounding environment) include several elements such as:

- Reporting all incidents to international authorities, regardless of whether the incident resulted in a release of a biological agent.
- Determining the cause of an incident to prevent a reoccurrence.
- Identifying biosafety deficiencies and gaps and implementing corrective actions.¹⁶

¹¹ Ibid.

¹² In 1983, WHO released a laboratory biosafety manual, which urged countries to accept and implement basic concepts in biosafety and to develop national codes of practice for the safe handling of pathogenic biological agents. The report was updated in 2020. Several countries have reportedly used the manual to develop national codes of practice, and a number of others that lack formal regulatory requirements reportedly rely on the manual as their sole guidance document. In January 2021, WHO also updated its *Laboratory Biosafety Guidance for Novel Coronavirus (2019-nCoV)*. WHO's team of international experts conducts biennial inspections of authorized maximum containment facilities. Additionally, participating countries may utilize the Joint External Evaluation Tool to voluntarily assess their capacities, gaps, opportunities and challenges in 19 technical areas, including biosafety and biosecurity. CDC leads U.S. engagement in this area. In November 2018, the GHSA Steering Group extended GHSA through 2024. The initiative is coordinated and carried out by more than 70 WHO Member States and more than 100 private partners, non-governmental organizations (NGO), and multilateral organizations. For more information on IHR (2005), WHO and global health security issues, see CRS In Focus IF11461, *The Global Health Security Agenda (GHSA): 2020-2024*, by Tiaji Salaam-Blyther and CRS In Focus IF10022, *The Global Health Security Agenda (2014-2019) and International Health Regulations (2005)*, by Tiaji Salaam-Blyther.

¹³ The regulations mandate that WHO Member States build and maintain core public health capacities for disease surveillance and response; collaborate with other Member States to provide or facilitate technical assistance to help low-resource countries develop and maintain public health capacities; notify WHO of any event that may constitute a Public Health Emergency of International Concern (PHEIC) and respond to requests for verification of information regarding such event; and follow WHO recommendations concerning public health responses to the relevant PHEIC.

¹⁴ U.S. Department of Health and Human Services (HHS), Assistant Secretary for Preparedness and Response (ASPR), "Biosecurity FAQ," April 26, 2017, <https://www.phe.gov/s3/BioriskManagement/biosecurity/Pages/Biosecurity-FAQ.aspx#faq2>.

¹⁵ Ibid.

¹⁶ WHO, "Biosafety Programme Management," 2020, <https://www.who.int/publications/i/item/9789240011434>. The (continued...)

Other elements of biosafety programs may include but are not limited to short-term serum sampling of individuals after a potential exposure or during an investigation, or the implementation of screening programs to monitor for symptoms of possible infection.¹⁷ No reports of relevant laboratory incidents in Wuhan have been identified. A retrospective analysis could assess if a laboratory or research incident may have occurred, and relevant options for such studies are summarized below.

WIV was not the only Wuhan institution studying coronaviruses from bats. In the years before the outbreak of COVID-19, Chinese state media reported that Wuhan Center for Disease Control (CDC) virus researcher Tian Junhua traveled Hubei Province collecting samples from bats in more than 100 caves.¹⁸ In discussing “[a]rguments in favour” of a lab leak hypothesis, the WHO Origin report notes, “The Wuhan CDC laboratory moved on 2nd December 2019 to a new location near the Huanan market. Such moves can be disruptive for the operations of any laboratory.” In its “[a]rguments against” discussion, it noted that the Wuhan CDC “reported no disruptions or incidents caused by the move. They also reported no storage nor laboratory activities on CoVs or other bat viruses preceding the outbreak.”¹⁹

Selected Possible Options for Further Study

Some scientists have recommended a variety of possible options for further research and inquiry, including:

- An independent review of the biosafety levels at WIV laboratories where bat coronavirus research was conducted, including detailed information on the training, safety procedures and infection monitoring protocols of lab personnel.²⁰
- An examination of WIV laboratory samples, notebooks and hard drives, among other materials. Some assert it is unclear what such an investigation would yield because China has not acceded to demands for a full lab investigation.²¹
- An investigation of hospital records and blood specimens from WIV staff members, particularly those taken in the months leading up to the COVID-19 Pandemic.²²

International Organization for Standardization (ISO) has issued guidelines for Biorisk management for laboratories and other related organizations; see more at <https://www.iso.org/obp/ui/#iso:std:iso:35001:ed-1:v1:en>. The Clinical & Laboratory Standards Institute (CLSI): A not-for-profit organization which encourages the development and use of laboratory guidelines and standards. This organization has a guideline which recommends safety practices intended to increase biosafety; see more at <https://webstore.ansi.org/standards/clsi/clsim29a3>.

¹⁷ CDC, “*Biosafety in Microbiological and Biomedical Laboratories 6th Edition*,” June 2020, https://www.cdc.gov/labs/pdf/SF_19_308133-A_BMBL6_00-BOOK-WEB-final-3.pdf.

¹⁸ “曾被疑为“零号患者”的田俊华，蝙蝠栖息洞穴是他的主战场” (“For Tian Junhua, Once Suspected of Being Patient Zero, Bat Habitats Are His Main Battlefield”), 健康时报 (*Health Times*), March 13, 2020, http://www.jksb.com.cn/html/2020/jjxxgzbd_0313/160535.html. Eva Dou and Lily Kuo, “A scientist adventurer and China’s ‘Bat Woman’ are under scrutiny as coronavirus lab-leak theory gets another look,” *The Washington Post*, June 3, 2021, https://www.washingtonpost.com/world/asia_pacific/coronavirus-bats-china-wuhan/2021/06/02/772ef984-beb2-11eb-922a-c40c9774bc48_story.html.

¹⁹ WHO Origin Report, p. 119.

²⁰ Arthur Allen, “To the Bat Cave: In Search of Covid’s Origins, Scientists Reignite Polarizing Debate on Wuhan ‘Lab Leak,’” *KHN*, May 18, 2021, <https://khn.org/news/article/wuhan-lab-leak-coronavirus-virologists-seek-inquiry-covid-origins-bat-research/>.

²¹ Maxmen and Mallapaty, p. 313.

²² Michael R. Gordon, Warren P. Strobel and Drew Hinshaw, “Intelligence on Sick Staff at Wuhan Lab Fuels Debate on Covid-19 Origin,” *The Wall Street Journal*, May 23, 2021, <https://www.wsj.com/articles/intelligence-on-sick-staff-at-wuhan-lab-fuels-debate-on-covid-19-origin-11621796228>.

Studies and Data of SARS-CoV-2 Features

Phylogenetic analysis—the study of the genetic and functional make-up of an organism—can help scientists determine the origin of a virus. Scientists use phylogenetic analysis to analyze the genomes of coronaviruses in these efforts. Phylogenetic analysis can:

- help scientists measure the relationship among viral strains and their evolutionary history;
- identify key features that enable the virus to function (e.g., features that enable the virus to be transmitted efficiently among humans); and
- provide evidence to identify a zoonotic origin of a virus and potentially an intermediate host or an artificial origin.²³

Scientists are studying features of SARS-CoV-2 to gain information on the potential origin of the virus. For example, the receptor binding domain (RBD) on the virus is approximately 97.2% similar to the RBD in a related coronavirus found in pangolins.²⁴ Further, the RBD shows stronger binding to human and pangolin receptors than RaTG13, the closest related known coronavirus to SARS-CoV-2.²⁵ The similarity of this feature and its binding properties suggests that pangolins might carry a coronavirus similar to SARS-CoV-2 and be a potential intermediate host.²⁶ (For further discussion, see section below on “Studies and Data to Address a Potential Zoonotic Origin of SARS-CoV-2.”)

Researchers are conducting genetic studies of SARS-CoV-2 to determine whether the virus has a zoonotic, manufactured or altered origin. Some researchers and stakeholders have studied the characteristics of the SARS-CoV-2 to examine a claim that certain features of SARS-CoV-2 are “unique” and thus potentially indicative of genetic manipulation.²⁷ Specifically, some scientists claim that “(1) the presence of a furin cleavage site²⁸ (missing in other coronaviruses of the same group) and (2) a receptor binding domain (RBD) optimized to bind to human cells might be the result of lab manipulation techniques.”²⁹ WIV maintains an extensive catalogue of coronaviruses collected from bats in caves and abandoned mines and has reportedly cultured three SARS-related coronaviruses from bats.³⁰ Some stakeholders have argued that SARS-CoV-2 could have been artificially derived from these samples.³¹ Other scientists note that other coronaviruses, scattered across the evolutionary tree for the family, have furin cleavage sites, thus supporting a natural origin for furin cleavage sites.³² These scientists note that the furin cleavage site in SARS-CoV-2 might have evolved multiple times to gain its evolutionary

²³ Yuhuan Wu et al., “Current Knowledge of COVID-19: Advances, Challenges, and Future Perspectives,” *Biosafety and Health*, vol. 3, no. 4 (August 2021), pp. 202-209.

²⁴ Tao Zhang et al., “Probable Pangolin Origin of SARS-CoV-2 Associated with the COVID-19 Outbreak,” *Current Biology*, vol. 30, no. 7 (April 6, 2020), pp. 1346-1351; and Antoni G. Wrobel et al., “Structure and Binding Properties of Pangolin-CoV Spike Glycoprotein Inform the Evolution of SARS-CoV-2,” *Nature Communications*, vol. 12, no. 837 (February 5, 2021). Hereafter, Antoni G. Wrobel et al., “Structure and Binding Properties of Pangolin-CoV.”

²⁵ Antoni G. Wrobel et al., “Structure and Binding Properties of Pangolin-CoV.”

²⁶ Ibid.

²⁷ Maxmen and Mallapaty, p. 313

²⁸ The furin cleavage site is in the virus’s spike protein, and the cleavage of the protein at the furin cleavage site is necessary for the virus to infect cells.

²⁹ Rossana Segreto and Yuri Deigin, “The Genetic Structure of SARS-CoV-2 Does Not Rule Out a Laboratory Origin,” *BioEssays*, vol. 43, no. 3, November 17, 2020.

³⁰ Edward C. Holmes et al., “The Origins of SARS-CoV-2: A Critical Review,” Journal pre-print, *Cell*, 2021, pp. 1-33.

³¹ Maxmen and Mallapaty.

³² Yiran Wu and Suwen Zhao, “Furin Cleavage Sites Naturally Occur in Coronaviruses,” *Stem Cell Research*, vol. 50 (January 2021), pp. 1102-1115 (Hereinafter referred to as Yiran Wu and Suwen Zhao, “Furin Cleavage Sites”) and Holmes, et al., “Origin of SARS-CoV-2.”

advantage.³³ Other scientists contend that the furin cleavage site in SARS-CoV-2 is sub-optimal compared to other coronaviruses, which suggests it is not an engineered virus feature.³⁴

Selected Possible Options for Further Study

Globally, scientists have recommended a variety of possible options for further research and inquiry, such as:

- Collect large numbers of samples of wildlife associated with early SARS-CoV-2 outbreaks, and sequencing any coronavirus genomes found in these samples, to increase knowledge and data about the evolution of SARS-CoV-2.³⁵
- Study genetic sequences of key features of the viruses in species with coronaviruses to determine how they evolved, including the furin cleavage site.³⁶
- Study specific functional parts of SARS-CoV-2, such as the RBD, to determine if similarities in function and genetic sequences are found in coronaviruses in bats and other species.³⁷

Studies and Data to Address a Potential Zoonotic Origin of SARS-CoV-2

Human epidemics of zoonotic origin, in which wildlife transmits a pathogen to humans, are well documented.³⁸ Transmission of a virus to humans may occur directly from an animal reservoir (e.g., the animal where the virus lives, grows, and multiplies), or indirectly through an intermediate host (e.g., an animal infected by an animal reservoir that carries the virus and transmits it to humans). Intermediate hosts may increase *viral spillover*³⁹ by increasing transmissibility or infectiousness via viral adaption from the primary host.⁴⁰ Scientists note that confirming a zoonotic origin of a virus that infects humans requires rigorous study and may take years to complete.⁴¹ The origins of several pathogens that infect humans including Ebola virus, hepatitis C and poliovirus have not been identified and some suggest might never be found.⁴² Investigations into the origins of Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) took several years of searching and sampling before scientists were able definitively to link the origin of the SARS virus to bats in a specific cave in China;⁴³ or determine

³³ Maxmen and Mallapaty.

³⁴ Holmes, et al.

³⁵ WHO Origin Report, p. 109 and David A. Relman, "Opinion: To Stop the Next Pandemic, We Need to Unravel the Origins of COVID-19," *Proceedings of the National Academy of Sciences*, vol. 117, no. 47 (November 24, 2020), pp. 29246-29248.

³⁶ Yiran Wu and Suwen Zhao.

³⁷ Wrobel et al.,.

³⁸ CDC, "Zoonotic Diseases," <https://www.cdc.gov/onehealth/basics/zoonotic-diseases.html>.

³⁹ A viral spillover occurs when a viral pathogen moves from one species into another species. See C. Brown, "Spillover: Animal Infection and the Next Human Pandemic," *Emerging Infectious Diseases*, vol. 19, no. 2, (2013), p. 349.

⁴⁰ Ria R. Ghai et al., "Animal Reservoirs and Hosts for Emerging Alphacoronaviruses and Betacoronaviruses," *Emerging Infectious Diseases*, vol. 27, no. 4 (April 2021).

⁴¹ Edward C. Holmes, et al, "Origin of SARS-CoV-2."

⁴² Edward C. Holmes, et al, "Origin of SARS-CoV-2."

⁴³ David Cyranoski, "Bat Cave Solves Mystery of Deadly SARS Virus—and Suggests New Outbreak Could Occur," *Nature news*, December 1, 2017, <https://www.nature.com/articles/d41586-017-07766-9>.

that dromedary camels are an intermediate host for the MERS virus. The investigation of the zoonotic origin of the MERS virus; have not confirmed a specific animal reservoir linked to its origin.⁴⁴

Many scientists, including the experts deployed as part of the WHO team, identified several reasons why a zoonotic origin for SARS-CoV-2 may be possible.⁴⁵ A number of early cases of SARS and SARS-CoV-2 involved people associated with markets in Wuhan, either as customers, vendors, or relatives of people in those groups.⁴⁶ This suggests, according to some scientists, that the potential close proximity of animals may have facilitated a zoonotic transmission of SARS-CoV-2 from animals to humans.⁴⁷ The WHO team reported that 55% of SARS-CoV-2 cases in December 2019 were connected to wet markets in Wuhan, China, including the Wuhan Huanan Seafood Wholesale Market (hereafter Huanan market), which might indicate a possible zoonotic link.⁴⁸ Early associations had been made between the Huanan market as a source of initial transmission of the virus to humans or as an amplifier of its spread; however, the WHO Origin Report stated that “no firm conclusion... about the role of the Huanan market in the origin of the outbreak, or how the infection was introduced into the market, can currently be drawn.”⁴⁹

In addition to epidemiological studies, scientists examine the overall genetic similarity and functional similarity between viruses found in humans and animals to determine a potential zoonotic transmission. For example, the genetic similarity of the SARS in humans compared with SARS in wildlife was 99.8%, indicating a zoonotic source.⁵⁰ Similarly, SARS-CoV-2 has many genetic similarities with established zoonotic coronaviruses.⁵¹ SARS-CoV-2 is genetically similar to SARS, which was determined to have a zoonotic origin in bats and to have been subsequently transferred to humans via civets as an intermediate host.⁵² SARS-CoV-2 is most similar to four endemic human coronaviruses: HCoV-OC43, HCoV-HKU1, HCoV-229E, and HCoV-NL63; all of which have zoonotic origins.⁵³ The publicly documented virus most genetically similar virus to SARS-CoV-2 (approximately 96% similar) is RaTG13 from horseshoe bats, a known carrier of coronaviruses.⁵⁴ According to Xu Nanping, Vice Minister of China’s Ministry of Science and Technology, Chinese scientists found that the bat coronavirus RaTG13, sampled in Yunnan Province, has an overall genetic similarity of 96.2% with SARS-CoV-2 genome, and an 89.3% genetic similarity in the receptor-binding domain (RBD).⁵⁵ This genetic similarity is not sufficient to conclusively assign the origin of SARS-CoV-2 to horseshoe bats, according to several scientists.⁵⁶ According to the

⁴⁴ WHO, “Middle East respiratory syndrome coronavirus (MERS-CoV),” [https://www.who.int/news-room/fact-sheets/detail/middle-east-respiratory-syndrome-coronavirus-\(mers-cov\)](https://www.who.int/news-room/fact-sheets/detail/middle-east-respiratory-syndrome-coronavirus-(mers-cov)).

⁴⁵ Edward C. Holmes, et al, “Origin of SARS-CoV-2.”

⁴⁶ A “wet” market is one that sells live or recently butchered animals as well as other products.

⁴⁷ For more information, see CRS In Focus IF11494, *Wildlife Trade, COVID-19, and Other Zoonotic Diseases*, by Pervaze A. Sheikh and Katarina C. O'Regan

⁴⁸ WHO Origin Report, p. 44.

⁴⁹ WHO Origin Report, p.7.

⁵⁰ L.F. Wang and B.T. Eaton, “Bats, Civets and the Emergence of SARS,” in *Wildlife and Emerging Zoonotic Diseases: The Biology, Circumstances and Consequences of Cross-Species Transmission. Current Topics in Microbiology and Immunology*, ed. J.E. Childs, J.S. Mackenzie, and J.A. Richt, vol. 315 (Springer, 2007), pp. 325-344.

⁵¹ Edward C. Holmes, et al, “Origin of SARS-CoV-2.”

⁵² M.F. Boni et al., “Evolutionary Origins of the SARS-CoV-2 Sarbecovirus Lineage Responsible for the COVID-19 Pandemic.”

⁵³ Edward C. Holmes, et al, “Origin of SARS-CoV-2.”

⁵⁴ Hayden Hedman, et al, “Host Diversity and Potential Transmission Pathways of SARS-CoV-2 at the Human-Animal Interface,” *Pathogens*, vol. 10 (February 2021).

⁵⁵ State Council Information Office, “SCIO Press Conference on COVID-19 Origin Tracing,” July 22, 2021, http://english.scio.gov.cn/pressroom/2021-07/25/content_77650203.htm.

⁵⁶ See “Studies and Data to Address a Potential Zoonotic Origin of SARS-CoV-2”. Edward C. Holmes et al., “The Origins of SARS-CoV-2: A Critical Review,” Journal pre-print, *Cell*, 2021, pp. 1-33. Hereinafter, Edward C. Holmes, et al, “Origin of SARS-CoV-2.”

WHO Origin Report, the genetic distance of 4% may represent decades of evolutionary divergence.⁵⁷ This has led some scientists to suggest that an intermediate host species may have carried the virus before it infected humans.⁵⁸

The search for a potential intermediate host for SARS-CoV-2 is based on genetic similarities and functional characteristics (e.g., RBD, furin cleavage sites) between SARS-CoV-2 found in humans and other species, such as pangolins. Initial studies documented similarities between coronaviruses found in pangolins and SARS-CoV-2, but did not conclude that pangolins are intermediate hosts.⁵⁹ Chinese officials also referred to pangolins as a potential intermediate host. For example, according to Vice Minister Xu, Chinese scientists “detected multiple strains of coronavirus in smuggled pangolins seized by Customs,” including one that “may have played a role in the evolution of SARS-CoV-2.”⁶⁰ Other species associated with wet markets that have the propensity to carry coronaviruses are potential candidates for an intermediate host; including turtles, mink, civets, and ferrets, among others.⁶¹ However, as of September 17, 2021, scientists have not definitively identified a bat, other species reservoir, or an intermediate animal host for SARS-CoV-2.⁶²

Testing animals for the presence of coronaviruses and conducting phylogenetic analyses on potential strains of interest are first steps in determining a zoonotic origin for a virus. According to the WHO Origin Report, Chinese investigators analyzed 80,000 samples from wild and domestic animals, finding no evidence of SARS-CoV-2 antibodies or nucleic acids.⁶³ This was confirmed by Vice Minister Xu, who stated that Chinese scientists had tested over 80,000 animal samples from dozens of species, including pigs, cattle, sheep, chickens, ducks, geese, pigeons, turkeys, wild rabbits, and wild boars. Vice Minister Xu said Chinese scientists had also “conducted COVID-19 challenge trials on animals around us in the lab, and classified them into groups according to their susceptibility to COVID-19 infection” to help “determine the priorities in terms of tracing animal origins.”⁶⁴

The WHO Origin Report also stated that although scientists did not find evidence of animal infection in the Huanan market, environmental sampling from the market revealed “widespread contamination of surfaces with SARS-CoV-2”—further noting that contamination could have been introduced via infected people, animals, or products.⁶⁵ Separately, an early sampling of the market by Chinese officials did reveal the presence of SARS-CoV-2 at the market.⁶⁶ Officials noted that 33 out of 585 samples collected at the Wuhan market contained the nucleic acid sequence of SARS-CoV-2, and that 31 of the 33 samples that collected in the western zone of the market where wildlife trading was concentrated were positive for SARS-CoV-2.⁶⁷

⁵⁷ WHO Origin Report, p. 115.

⁵⁸ M.F. Boni et al., “Evolutionary Origins of the SARS-CoV-2 Sarbecovirus Lineage Responsible for the COVID-19 Pandemic,” *Nature Microbiology*, vol. 5, no. 11 (November 2020), pp. 1408-1417.

⁵⁹ Antoni G. Wrobel et al., “Structure and Binding Properties of Pangolin-CoV.”

⁶⁰ State Council Information Office, “SCIO Press Conference on COVID-19 Origin Tracing,” July 22, 2021, http://english.scio.gov.cn/pressroom/2021-07/25/content_77650203.htm.

⁶¹ For example, see Jie Zhao et al., “The Potential Intermediate Hosts for SARS-CoV-2,” *Frontiers in Microbiology*, vol. 30 (September 2020).

⁶² Edward C. Holmes, et al, “Origin of SARS-CoV-2.”

⁶³ WHO Origin Report, p.8.

⁶⁴ State Council Information Office, “SCIO Press Conference on COVID-19 Origin Tracing,” July 22, 2021, http://english.scio.gov.cn/pressroom/2021-07/25/content_77650203.htm.

⁶⁵ WHO Origin Report, p.8.

⁶⁶ “China Detects Large Quantity of Novel Coronavirus at Wuhan Seafood Market,” *XinhuaNet*, January 27, 2020, http://www.xinhuanet.com/english/2020-01/27/c_138735677.htm.

⁶⁷ Ibid.

Several scientists have stated that these findings were not sufficient to rule out a zoonotic origin for the virus.⁶⁸ Many members of the international scientific community contend that pursuing further investigations to identify animal reservoirs of SARS-CoV-2 (or close relatives) would benefit from a coordinated approach that involves, in part, working through human samples to identify early human infections and potential links to wildlife.⁶⁹ Some scientists caution that as time passes, SARS-CoV-2 antibodies will diminish, making it more difficult to trace early human and animal infections.⁷⁰ In addition, some scientists contend that cooperation with China in identifying and sampling animals for the presence of coronaviruses is also critical (for further discussion, see the section below on “China’s Position on Further Investigative Work”).

Selected Possible Options for Further Study

Globally, scientists have recommended a variety of possible options for further research and inquiry, including:⁷¹

- Track down the earliest cases of SARS-CoV-2, and study potential connections to wildlife to understand the pandemic’s origins.⁷² The WHO Origin Report notes that the number of samples of livestock and farmed wildlife is large, but more sampling is necessary to determine if animals are carrying SARS-CoV-2 or similar coronaviruses.⁷³
- Trace animals that might have been sold in the Huanan market and other Wuhan markets back to their place of origin to sample other animals for coronaviruses.⁷⁴ This could be facilitated by an analysis of trade in animals from markets in Wuhan.⁷⁵
- Conduct serology sampling and interviews with individuals who handled or farmed wildlife connected to the Wuhan wet markets, including farmers, vendors, delivery staff, cold-chain suppliers and other relevant individuals who might have handled wildlife products, in order to identify the past exposure to coronaviruses, including SARS-CoV-2.⁷⁶
- Expand wildlife sampling to include bats, domestic and wild animals, and submit sequenced genomes to publicly accessible databases.⁷⁷ According to the WHO Origin Report, sampling should initially focus on farmed wildlife or livestock that have potential

⁶⁸ See for example, Jessica McDonald, “Fact Check: The Facts – and Gaps – on the Origin of the Coronavirus,” *NBCDFW*, June 28, 2021, <https://www.nbcdfw.com/news/national-international/fact-check-the-facts-and-gaps-on-the-origin-of-the-coronavirus/2668053/>.

⁶⁹ WHO Origin Report, p. 109; and “‘In an Ocean of Ashes, Islands of Order’: WHO’s SARS-CoV-2 origin report,” *The Lancet Infectious Diseases*, editorial, April 9, 2021.

⁷⁰ Marion Koopmans et al., “Origins of SARS-CoV-2: Window is Closing for Key Scientific Studies,” *Nature*, August 25, 2021.

⁷¹ CRS reviewed the relevant literature and compiled this list of selected options for further study, CRS does not make recommendations and inclusion of a “selected option” does not constitute a recommendation by CRS or its analysts for further research in this area.

⁷² WHO Origin Report, p. 114.

⁷³ WHO Origin Report, p. 109.

⁷⁴ WHO Origin Report, p. 8.

⁷⁵ WHO Origin Report, p. 8.

⁷⁶ WHO Origin Report, p. 109; and Spyros Lytras, et al., “The Animal Origin of SARS-CoV-2: Trading of Animals Susceptible to Bat Coronaviruses Is the Likely Cause of the COVID-19 Pandemic,” *Science*, vol. 373, August 27, 2021, pp. 969-970.

⁷⁷ See for example, Smriti Mallapaty, “After the WHO report: What’s next in the Search for COVID’s Origins?” *Nature*, vol. 592, April 15, 2021, p. 337, <https://media.nature.com/original/magazine-assets/d41586-021-00877-4/d41586-021-00877-4.pdf>

to be infected; species bred for food such as ferret-badgers and civets; and species bred for fur such as mink and raccoon dogs in farms.⁷⁸

- Broaden the search for the virus's zoonotic origin beyond China, due to recent reports of coronaviruses closely related to SARS-CoV-2 identified in bats in Japan, Cambodia and Thailand.⁷⁹ Scientists note that focusing on the most likely potential hosts might reduce the sampling burden. In addition to certain species of bats, scientists have found coronaviruses similar to SARS-CoV-2 in pangolins, and coronaviruses that share a similar receptor binding domain in small carnivores, such as ferrets, cats, and snakes.⁸⁰ China has reportedly started such investigations, but little information on their status has been released to the international scientific community.⁸¹
- Conduct further research into the legal and illegal trade of species associated with wildlife and wet markets in Yunnan Province in China's southwest, due to the hypothesis that a zoonotic origin of the virus could be the consequence of illegal trade and consumption of wild animals.⁸² Tracing wildlife transactions that are illegal might be challenging due to the covert nature of wildlife trafficking. For example, one study reported that 17 shops in four markets spread across Wuhan sold wildlife from 2017 to 2019 without displaying a certificate of origin or quarantine certificate, thus making their commerce illegal and difficult to trace.⁸³
- Use DNA barcoding of animal product samples from the Huanan market and other Wuhan markets to identify potential species that might carry coronaviruses that could be transmitted through the food chain.⁸⁴
- Conduct further studies to improve understanding of the possible role of viral transmission in frozen wildlife or other animal products kept in cold chain. Specifically, the WHO team recommended conducting retrospective tests for SARS-CoV-2 from products supplied to the Huanan market in 2019 (if available), as well as studying the persistence and viability of the virus at different temperatures on foodstuffs.⁸⁵
- Investigate if there could have been multiple zoonotic transmission events from animals to humans in the early stages of the COVID-19 pandemic. This recommendation is based on a phylogenetic analysis of coronavirus strains collected early in the pandemic in

⁷⁸ WHO Origin Report, p. 109.

⁷⁹ Ibid.; and Supaporn Wacharapluesadee et al., "Evidence for SARS-CoV-2 Coronaviruses Circulating in Bats and Pangolins in Southeast Asia," *Nature*, vol. 12, no. 972 (February 9, 2021).

⁸⁰ Alexandre Hassanin, et al., "Covid-19: Natural or Anthropogenic Origin?" *Mammalia* (Berlin) 85, no. 1, January 2021, pp. 1-7, <https://www.degruyter.com/document/doi/10.1515/mammalia-2020-0044/html>.

⁸¹ David Cyranoski, "The Biggest Mystery: What it will Take to Trace the Coronavirus Source," *Nature*, June 5, 2020, <https://www.nature.com/articles/d41586-020-01541-z>.

⁸² Alexandre Hassanin, et al., "Covid-19: Natural or Anthropogenic Origin?"

⁸³ Xiao Xiao et al., "Animal Sales from Wuhan Wet Markets Immediately Prior to the COVID-19 Pandemic," *Science*, vol. 11 (June 7, 2021).

⁸⁴ WHO Origin Report, p. 109.

⁸⁵ The WHO Origin Report cited three recent SARS-CoV-2 outbreaks in China that "have been linked to exposure to imported refrigerated or frozen seafood products." The report also referenced a study that found that the infectivity of SARS-CoV-2 did not decline on cold chain products after 21 days at four degrees Celsius (for refrigerated food) or negative twenty degrees Celsius (for frozen food). See WHO Origin Report, p. 109.

Wuhan that appear to group into two lineages.⁸⁶ If confirmed, this might indicate multiple zoonotic transmission events in Wuhan.⁸⁷

Human Epidemiology Studies

According to WHO, the earliest recognized cases of COVID-19 in Wuhan were thought to have occurred in early December 2019.⁸⁸ Identifying the time and location of the earliest human infections may provide insight into the origins of the virus, and focus further studies. Efforts to detect the earliest cases of COVID-19 have focused on Wuhan, in Hubei Province, where the earliest cases identified to date were found. The possibility that the virus emerged elsewhere has not been ruled out, however. In addition, identifying the earliest variant(s) of the pandemic virus itself, while more difficult, could illuminate the process by which it became transmissible among humans, and insights into prevention of future pandemics.⁸⁹

The WHO team pursued several avenues to identify the earliest cases of COVID-19 in China, which they discuss in the “Epidemiology” section of the WHO Origin report.⁹⁰ They reviewed information from 2019 from existing surveillance systems for influenza-like illness (ILI) and severe acute respiratory infection (SARI), which China established after the SARS outbreak in 2003, to determine if any earlier cases of illness may have been caused by SARS-CoV-2.⁹¹ In addition, the WHO team tested a limited sample of stored human specimens from ILI and SARI patients for SARS-CoV-2.⁹² The team also reviewed mortality statistics overall and from various specific causes, and conducted several additional studies of patient antibody levels, and of the times and places where confirmed cases were found.

The WHO team found “a marked increase in ILI in both children and adults,” in Wuhan, in the remainder of Hubei Province, and in six neighboring provinces and municipalities, beginning in December, 2019.⁹³ This was thought to signal the initial COVID-19 cases. Findings from SARI surveillance were inconclusive, and the virus was not found in any human specimens collected from ILI patients in October through December of 2019.⁹⁴ Mortality increases were not seen until January 2020, and retrospective studies of antibodies did not suggest virus circulation prior to December 2019.⁹⁵ The WHO team also reviewed the earliest cases associated with the Huanan market and patients hospitalized at the time in Wuhan. Findings from these studies were either inconclusive, or they supported a conclusion that SARS-CoV-2 emerged in early December 2019 and was not present earlier in the Wuhan area.⁹⁶ The team

⁸⁶ The diversion of two sub-lineages of SARS-CoV-2 is unclear, specifically the WHO Report states that “When and where these two sublineages diverged remains unclear, and these analyses indicate the origins of SARS-CoV-2 are not yet fully understood.” WHO Origin Report, p. 67.

⁸⁷ Smirti Mallapaty, “Did the Coronavirus Jump from Animals to People Twice,” *Nature*, September 16, 2021.

⁸⁸ WHO Origin Report, p. 16.

⁸⁹ Yuhuan Wu et al., “Current Knowledge of COVID-19: Advances, Challenges, and Future Perspectives,” *Biosafety and Health*, vol. 3, no. 4 (August 2021), pp. 202-209.

⁹⁰ WHO Origin Report, pp. 16-57.

⁹¹ These systems track hospital visits for ILI and SARI syndromes, i.e., suites of symptoms that could reflect influenza or another respiratory illness, regardless of laboratory testing results. These systems provide an earlier warning of a surge in infections, compared with testing data, and can warn of an emergent respiratory illness for which testing is not yet available.

⁹² These studies used data from one or more hospitals in Wuhan, and elsewhere in Hubei and surrounding provinces, where available.

⁹³ WHO Origin Report, p. 23. The increase was relative to the average of ILI reports from the previous three years.

⁹⁴ WHO Origin Report, pp. 23-25.

⁹⁵ WHO Origin Report, p. 54.

⁹⁶ Results are summarized in WHO Origin Report, pp. 53-55.

recommended further studies, discussed in the section below “Selected Possible Options for Further Study.”

Upon release of the WHO Origin report, critics claimed that the Chinese government had limited the WHO team’s access to sites and data that were germane to the investigation.⁹⁷ In public remarks, WHO Director-General Dr. Tedros said

The team reports that the first detected case had symptom onset on the 8th of December 2019. But to understand the earliest cases, scientists would benefit from full access to data including biological samples from at least September 2019.

In my discussions with the team, they expressed the difficulties they encountered in accessing raw data. I expect future collaborative studies to include more timely and comprehensive data sharing.⁹⁸

Several months later, in August 2021, the IC, in its unclassified summary report, said that

The IC will be unable to provide a more definitive explanation for the origin of COVID-19 unless new information allows them to determine the specific pathway for initial natural contact with an animal or to determine that a laboratory in Wuhan was handling SARS-CoV-2 or a close progenitor virus before COVID-19 emerged.

The IC—and the global scientific community—lacks clinical samples or a complete understanding of epidemiological data from the earliest COVID-19 cases. If we obtain information on the earliest cases that identified a location of interest or occupational exposure, it may alter our evaluation of hypotheses.⁹⁹

Selected Possible Options for Further Study

Further study into the first human COVID-19 infections could address several different factors, including, among others: expanding the geographic range for retrospective study both within and beyond China; repeating or expanding prior analyses with more aggressive data-finding and more sophisticated statistical methods; repeating and expanding specimen testing using more sensitive tests developed since the WHO team study; and studying previously unexplored sources of data and specimens. Specific possible options for further study follow.

The WHO team made 12 recommendations for further study in its report.¹⁰⁰ These recommendations include the following studies in China, among others:

- more thorough analysis of ILI data from 2019, applying more sophisticated statistical analyses.
- expanded study of pharmacy purchases in the fall of 2019, compared with prior years.
- analysis of 2019 mortality data from all areas of China that experienced early COVID-19 spread, in the event that Wuhan/Hubei Province were not the sites of emergence of the pandemic virus.

⁹⁷ See for example Emily Rauhala, “WHO Chief, U.S. and other World Leaders Criticize China for Limiting Access of Team Researching Coronavirus Origins,” *The Washington Post*, March 30, 2021.

⁹⁸ WHO, “WHO Director-General’s remarks at the Member State Briefing on the report of the international team studying the origins of SARS-CoV-2,” March 30, 2021, <https://www.who.int/director-general/speeches/detail/who-director-general-remarks-at-the-member-state-briefing-on-the-report-of-the-international-team-studying-the-origins-of-sars-cov-2>.

⁹⁹ Office of the Director of National Intelligence, *Unclassified-Summary-of-Assessment-on-COVID-19-Origins*, August 26, 2021, <https://www.dni.gov/files/ODNI/documents/assessments/Unclassified-Summary-of-Assessment-on-COVID-19-Origins.pdf>. See also ODNI, “ODNI Issues Summary of Assessment on COVID-19 Origins,” press release, August 27, 2021, <https://www.dni.gov/index.php/newsroom/press-releases/press-releases-2021/item/2237-odni-issues-summary-of-assessment-on-covid-19-origins>.

¹⁰⁰ Recommendations are summarized in WHO Origin Report, pp. 55-56.

- further study of the earliest cases of COVID-19 illness, as well as patients with compatible symptoms, including retesting of associated clinical specimens.
- antibody testing of specimens from the Wuhan blood bank collected during the fall of 2019, with possible expansion to other blood banks in China and other countries.

In August 2021, members of the WHO team published a statement noting priorities for further investigation, as well as the time-sensitive nature of some of these avenues, saying

Crucially, the window is rapidly closing on the biological feasibility of conducting the critical trace-back of people and animals inside and outside China. SARS-CoV-2 antibodies wane, so collecting further samples and testing people who might have been exposed before December 2019 will yield diminishing returns.¹⁰¹

The team's stated priorities for further investigations in human epidemiology are:

Further trace-back studies. On the basis of disease reporting, look for early COVID-19 cases in all regions inside and outside China that have the earliest evidence for SARS-CoV-2 circulation.

Antibody surveys. Use standardized methods in the regions that have the earliest evidence for SARS-CoV-2 circulation (inside and outside China) to identify any places where infections occurred that were not observed through disease reporting.

Detailed risk-factor analysis. [Analyze] pockets of earlier cases evidenced from the antibody surveys or other studies, and conduct an assessment of all possible exposures.¹⁰²

According to the WHO team and others, expanding the review of mortality and ILI/SARI beyond Hubei province could clarify whether SARS-CoV-2 circulation in humans was present before the outbreak in Wuhan. Contact tracing and clinical reports linked public gatherings, and further analysis of purchases of cold medicine and use of traditional Chinese medicine may also be helpful.¹⁰³ Similarly, re-examining more complete data and specimens from early COVID-19, using newer technology, could also uncover earlier human infections in China and possibly other countries in 2019.¹⁰⁴

Testing for antibodies in blood from stored blood bank donations is a common way to screen for the first signs of a new type of infection or outbreak.¹⁰⁵ Testing specimens from late 2019 could yield evidence of antibodies against SARS-CoV-2 and provide insight into when and where the virus first infected humans in China.¹⁰⁶ Some scientists suggest that studies of blood donations should be extended to other provinces and regions outside of China.¹⁰⁷

¹⁰¹ Koopmans, Marion, et al., "Comment: Origins of SARS-CoV-2: Window Is Closing for Key Scientific Studies," *Nature*, August 25, 2021, <https://www.nature.com/articles/d41586-021-02263-6>.

¹⁰² Ibid.

¹⁰³ Editorial, "In an Ocean of Ashes, Islands of Order: WHO's SARS-CoV-2 Origin Report," *The Lancet Infectious Diseases*, April 9, 2021, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8040650/>.

¹⁰⁴ Ibid; and WHO Origin Report.

¹⁰⁵ See for example Sridhar V. Basavaraju, Monica E. Patton, Kacie Grimm, et al., "Serologic Testing of US Blood Donations to Identify Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)—Reactive Antibodies: December 2019–January 2020," *Clinical Infectious Diseases*, vol. 72, Issue 12, June 15, 2021, <https://academic.oup.com/cid/article/72/12/e1004/6012472>.

¹⁰⁶ Smriti Mallapaty, Amy Maxmen, and Ewen Callaway, "Mysteries Persist after World Health Organization Reports on COVID-Origin Search," *Nature*, vol. 590, February 18, 2021, p. 371, <https://media.nature.com/original/magazine-assets/d41586-021-00375-7/d41586-021-00375-7.pdf>; , "In an Ocean of Ashes, Islands of Order: WHO's SARS-CoV-2 Origin Report," *The Lancet Infectious Diseases*, editorial, April 9, 2021, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8040650/>; and WHO Origin Report.

¹⁰⁷ James Gorman, "With Virus Origins Still Obscure, WHO and Critics Look to Next Steps," *The New York Times*, April 7, 2021, updated June 14, 2021, <https://www.nytimes.com/2021/04/07/health/coronavirus-lab-leak-who.html>.

Some recommendations for further study call for access to data that Chinese authorities may not provide to the international scientific community.¹⁰⁸

China's Position on Further Investigative Work

The WHO and many experts have called for further research in China, as well as in other countries, to determine the origins of SARS-CoV-2. Chinese authorities have insisted, however, that the focus of the investigation should shift away from China to other countries, describing the search for the virus' origins as "a global mission that should be conducted in multiple countries and localities."¹⁰⁹ They have denounced U.S. statements on origin tracing efforts and the IC's report on the origins of COVID-19, and worked to spread narratives suggesting that the origins of the pandemic may lie in the United States, rather than China.¹¹⁰

Clinical Data Sharing

In an August 2021 statement, WHO said that the next phase of investigation should "include a further examination of the raw data from the earliest cases and sera from potential early cases in 2019." The WHO statement praised Italy's government for sharing its raw data and allowing its samples to be re-tested outside the country, and indicated that such an approach "is no different from what we encourage all countries, including China, to support."¹¹¹

Chinese authorities, however, continue to assert that they cannot relinquish control of clinical data and biological samples. At a July 2021 press conference, Liang Wannian, team leader for the Chinese side of the joint WHO-China expert team, said Chinese authorities had shown international members of the team clinical data, including laboratory test data, from the earliest cases in China, and had jointly analyzed the data with them while the experts were on the ground in Wuhan. Liang said that because of Chinese regulations related to patient privacy, "we did not agree to give away the original data, nor did we allow them to copy it or take photos."¹¹²

The WHO team suggested that Chinese authorities "continue to identify other biobanks for retrospective laboratory testing, particularly in Wuhan." Noting that the Wuhan Blood Center handles approximately 200,000 donations annually, the WHO Origin Report recommended "the investigation of options for performing SARS-CoV-2-specific antibody testing in blood donors (including those who are regular donors) in Wuhan from September to December 2019."¹¹³ Liang told the press conference that a Chinese regulation, specifically Article 31 of the Measures for the Administration of Blood Stations, has delayed

¹⁰⁸ U.S. Mission to International Organizations in Geneva, "U.S. Support for WHO-Convened Phase 2 COVID Origins Study," press release, May 27, 2021, <https://geneva.usmission.gov/2021/05/27/us-support-for-who-convened-phase-2-covid-origins-study/>.

¹⁰⁹ Ministry of Foreign Affairs of the People's Republic of China, "Foreign Ministry Spokesperson's Remarks on Report of Joint WHO-China Study of Origins of SARS-CoV-2 Released by WHO," March 30, 2021.

¹¹⁰ Ministry of Foreign Affairs of the People's Republic of China, "Statement by Vice Foreign Minister Ma Zhaoxu on Release of U.S. Intelligence Report on COVID-19 Origins," August 28, 2021, https://www.fmprc.gov.cn/mfa_eng/wjbxw/t1902709.shtml; Ministry of Foreign Affairs of the PRC, "Foreign Ministry Spokesperson's Remarks on Disinformation about COVID-19 Origins Tracing Disseminated by U.S. Congressmen," August 3, 2021, https://www.fmprc.gov.cn/mfa_eng/xwfw_665399/s2510_665401/2535_665405/t1897136.shtml.

¹¹¹ World Health Organization, "WHO Statement on Advancing the Next Series of Studies to Find the Origins of SARS-CoV-2," August 12, 2021, <https://www.who.int/news/item/12-08-2021-who-statement-on-advancing-the-next-series-of-studies-to-find-the-origins-of-sars-cov-2>.

¹¹² State Council Information Office, "SCIO Press Conference on COVID-19 Origin Tracing," July 22, 2021, http://english.scio.gov.cn/pressroom/2021-07/25/content_77650203.htm.

¹¹³ WHO Origin report, pp. 50-53.

such testing.¹¹⁴ The article in question states, “The storage period for blood samples shall be two years after use of whole blood or components.”¹¹⁵

Liang told the press conference, “Once the blood from the Wuhan Blood Center is used and after the two-year validity term, meaning the samples meet the requirements stipulated in the Measures for the Administration of Blood Stations, we will carry out relevant works.” He added, “Related institutions from the Chinese side also express that, once they have the results, they will deliver them to both the Chinese and foreign expert teams.”¹¹⁶ If blood donated in the fall of 2019 were used immediately, the two-year waiting period for testing would appear to expire in the fall of 2021.

Liang was not asked why the Chinese government, which has promulgated new laws and revised existing ones in response to the COVID-19 pandemic, has not taken action to revise the Measures for the Administration of Blood Stations to allow for testing of samples in emergency circumstances, such as the ongoing pandemic, before the expiration of the two-year retention period.

Information Related to the Wuhan Laboratories

At the same press conference, Liang stated that because the WHO team concluded that a laboratory incident was “extremely unlikely,” “it is no longer necessary to continue to devote energy and resources to study this hypothesis.” For any further investigation of a lab leak hypothesis, Liang added, “we suggest, from the point of view of the Chinese experts, that the studies be conducted in countries that haven’t undergone lab inspections like the ones conducted in Wuhan.” At the same press conference, Zeng Yixin, Vice Minister of China’s National Health Commission, asserted that WHO’s proposal for further investigation into the lab leak hypothesis in China “showed disrespect for common sense and arrogance toward science,” and stated that China “cannot accept such a plan.”¹¹⁷

At the press conference, Yuan Zhiming, director of the Wuhan National Biosafety Laboratory and a researcher at the Wuhan Institute of Virology (WIV), said WIV had no immediate plans to restore public access to its main virus database, after taking it offline in September 2019. He said that, “The structure and content of the database are still being improved.” He also said, “The project team will analyze and systematically sort out the original data of the database and publish research results in the form of papers,” after which the database might be made public.¹¹⁸

Animal Testing

Liang told the press conference that he believed that further investigation of zoonotic transmission should be “the top priority” of work going forward, and not just in China. Liang said China would do further animal studies, including on such possible intermediate hosts as pangolins, civets, and minks. He stated that “further research on markets that have had outbreaks, including the upstream and downstream chains

¹¹⁴ State Council Information Office, “SCIO Press Conference on COVID-19 Origin Tracing,” July 22, 2021, http://english.scio.gov.cn/pressroom/2021-07/25/content_77650203.htm.

¹¹⁵ National Health Commission of the People’s Republic of China, “血站管理办法” (“Measures for the Administration of Blood Stations”), August 30, 2018, <http://www.nhc.gov.cn/fzs/s3576/201808/17c156cdbff24e479eec30717f986ec8.shtml>.

¹¹⁶ State Council Information Office, “SCIO Press Conference on COVID-19 Origin Tracing,” July 22, 2021, http://english.scio.gov.cn/pressroom/2021-07/25/content_77650203.htm.

¹¹⁷ State Council Information Office, “SCIO Press Conference on COVID-19 Origin Tracing,” July 22, 2021, http://english.scio.gov.cn/pressroom/2021-07/25/content_77650203.htm.

¹¹⁸ State Council Information Office, “SCIO Press Conference on COVID-19 Origin Tracing,” July 22, 2021, http://english.scio.gov.cn/pressroom/2021-07/25/content_77650203.htm. For information on the databases no longer accessible to the public, see DRASTIC, “An Investigation into the WIV Databases That Were Taken Offline,” Preprint, ResearchGate, February 2021, https://www.researchgate.net/publication/349073738_An_investigation_into_the_WIV_databases_that_were_taken_offline.

of farms, is also valuable.” In the meantime, he called for testing “on a larger scale” in other countries with bat populations, and for scientists in other countries to do more work focused on “natural evolution and animals.”¹¹⁹

¹¹⁹ State Council Information Office, “SCIO Press Conference on COVID-19 Origin Tracing,” July 22, 2021, http://english.scio.gov.cn/pressroom/2021-07/25/content_77650203.htm.

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